DEPARTMENT OF THE NAVY
ENGINEERING FIELD ACTIVITY, NORTHWEST
NAVAL FACILITIES ENGINEERING COMMAND
3505 NW ANDERSON HILL ROAD
SILVERDALE, WA 98383-9130

5090/SUBASE
09E02CD/4535
24 NOV 1993

Mr. Jeff Rodin
U.S. Environmental Protection
Agency (HW-074)
1200 Sixth Avenue
Seattle, WA 98101

Mr. Craig Thompson
Washington State Dept.
of Ecology
P.O. Box 47600
Olympia, WA 98504-7600

Dear Sirs:

Enclosed are copies of the Final *Explanation of Significant Difference (ESD)* for Site A and the Interim Remedial Action at Site F for Naval Submarine Base, Bangor (3 and 4 copies, respectively). All comments from Draft ESD documents have been incorporated, and a *Response to Selected Comments* section has been included for additional clarification.

Granular Activated Carbon technology will be used in place of Ultraviolet/Oxidation for the treatment of leachate from the soil washing at Site A and the groundwater containment system at Site F.

Your written concurrence of these documents is requested. If you have any questions, please contact me at (206) 396-5984.

Sincerely,

Chris M. Drury

CHRIS M. DRURY, P.E.
Remedial Project Manager
By direction of the
Commanding Officer

Encl:
(1) Final ESD Site A
(2) Interim Remedial Action at Site F
(3) Response to Selected Comments

Copy to: (w/o encl)
SUBASE Bangor (Code 851)
Hart Crowser (T. Flynn)

bcc:
AR 4.4 SUBASE OU 1 & 2
~~SF~~ 5.0 SUBASE OU 1 & 2
EFA NW (Code 09E02GR)

EXPLANATION OF SIGNIFICANT DIFFERENCES (ESD)
FOR SOIL AND GROUNDWATER REMEDIATION CHANGES
SITE A
SUBASE, BANGOR
BANGOR, WASHINGTON

Introduction

Bangor Ordnance Disposal Site A at the Naval Submarine Base, Bangor (SUBASE, Bangor) is located at the north end of SUBASE, Bangor. SUBASE, Bangor is located in Kitsap County, Washington, on Hood Canal approximately 10 miles north of Bremerton. The lead agency for this National Priorities List (NPL) site is the U.S. Navy. The U.S. Environmental Protection Agency (EPA) and the Washington State Department of Ecology (Ecology) have provided support and oversight on the preliminary studies, site investigations, remedial action alternative selection, remedial design, and remedial action for Site A.

This ESD is prepared in accordance with Section 117(c) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and Section 300.435(c)(2)(i) of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). It addresses the following changes to Site A soil and groundwater remediation requirements as described in the Site A Record of Decision (ROD):

- Contaminated soil in the leach basin will be amended with clean sand, and calcium chloride will be added to the wash water to enhance leaching of ordnance compounds from the soil;

- Granular activated carbon (GAC) technology will replace ultraviolet/oxidation (UV/Ox) technology for soil leachate treatment;

- The small volume (60 to 130 cubic yards) of surface soils in Debris Area 2 containing lead concentrations which exceed the cleanup standard will be left in place to minimize potential impacts to human health and the environment associated with soil disturbance; and

- Groundwater treatment will commence no later than July 1, 1996. (This deadline assures that groundwater treatment will not be delayed in the event that soil remediation takes longer than anticipated.)

Soil treatability studies demonstrated that leaching performance improves markedly when the leach basin soil is amended with sand and calcium chloride is added to the wash water. As a result of these studies, the recommended leachate recirculation flow rate increased from 50 gpm (assumed in the FS) to 300 gpm. In addition, new information became available regarding the cost and implementability of GAC treatment. A reevaluation of GAC versus UV/Ox technologies concluded that GAC treatment of the leachate is equally implementable, equally effective, and substantially less expensive than UV/Ox treatment.

Debris Area 2 surface soils containing up to 660 mg/kg lead (versus a cleanup standard of 250 mg/kg) are located in a steeply sloping, heavily wooded area. The extent of soils exceeding the cleanup standard is very limited and represents a small volume (60 to 130 cubic yards). Further evaluation of the potential risks associated with excavating this soil has determined that excavation presents a greater risk to human health and the environment than leaving this soil in place.

Finally, the Site A ROD states that groundwater treatment will be implemented to achieve RAOs, and specifies that groundwater treatment will not begin until soil remediation is completed. However, the time required to complete soil remediation is uncertain. Therefore, a deadline (July 1, 1996) is now provided for implementation of groundwater treatment. Periodic groundwater monitoring will be conducted prior to this deadline.

Public notice of this ESD will be published in a major local newspaper. The ESD will be available for review in the information repositories located at the following Kitsap regional libraries:

Central Kitsap Library (206) 377-7601
1301 Sylvan Way
Bremerton, Washington 98310

Bangor Branch (206) 779-9724
Naval Submarine Base, Bangor
Silverdale, Washington 98315-5000

The ESD will also become part of the Administrative Record File in accordance with NCP 300.825(a)(2). The Administrative Record for Site A is available between the hours of 0800 and 1600 at:

Engineering Field Activity, Northwest
Naval Facilities Engineering Command
1040 Hostmark Street
Poulsbo, WA 98370
(206) 396-5984

Summary of Site History, Contamination Problems, and Selected Remedy

Site A consists of a Burn Area, two Debris Areas, and a Stormwater Discharge Area. The Burn Area was used to detonate and incinerate various ordnance materials, including trinitrotoluene (TNT), flares, fuses, primers, smoke pots, smokeless powder, and black powder. The majority of these activities occurred between 1962 and 1975, followed by more limited disposal and testing through 1986. Inert solid waste materials (e.g., metal casings) from the Burn Area operations were deposited at the two adjacent Debris Areas. The Stormwater Discharge Area has received surface water runoff from the Burn Area since a diversion structure was completed in 1983. As a result of these activities, soil, surface water, and groundwater within various areas of Site A have received different types and quantities of releases of ordnance compounds, ordnance breakdown products, and metals.

In 1978, evaluation of SUBASE, Bangor waste disposal sites (including Site A) began under the Navy Assessment and Control of Installation Pollutants (NACIP) program. Work at Site A continued in 1981 as part of an Initial Assessment Study (IAS) and in 1986 as part of a Characterization Study, both under the NACIP program. With the enactment of the Superfund Amendments and Reauthorization Act (SARA) in 1986, the Navy suspended further NACIP program activities and phased into the EPA Remedial Investigation/Feasibility Study (RI/FS) program. In July 1987, EPA included Site A on the NPL of hazardous waste sites.

The Site A ROD was signed on December 10, 1991. The selected remedy contained in the ROD has two parts, which address contaminated soil and groundwater, respectively. The selected soil remedy consists of the following:

- Excavate approximately 7,000 cubic yards of ordnance-contaminated surface soil from the Burn Area and approximately 100 cubic yards of ordnance- and/or lead-contaminated surface soil from Debris Area 2;

- Modify excavated soils as necessary to enhance leaching, and place modified soils in a lined leach basin constructed in the Burn Area. Place lead-contaminated soil (from Debris Area 2) in a segregated cell within the leach basin;

- Leach ordnance contaminants from the excavated soils in the basin using a Soil Washing system, and treat the circulating leachate with UV/Ox technologies until ordnance cleanup levels are achieved in both the soil and the leachate; and

- Remove lead-contaminated Debris Area 2 soils from the leach basin and dispose of them at an off-site landfill.

The selected groundwater remedy consists of extracting groundwater from the Shallow Aquifer, treating it using UV/Ox technologies, and disposing of the treated water on base by reintroduction to the Shallow Aquifer.

Description of the Significant Differences and the Basis for those Differences

Add Sand Amendment to Leach Basin Soil and Calcium Chloride to Wash Water

The Site A ROD states that "the excavated soils will be modified as necessary by mechanical or chemical means to ensure that the subsequent treatment (washing) process will be effective and efficient." Soil treatability studies were performed by the Navy after the ROD was signed to tailor the use of soil washing technology for leaching of ordnance compounds from Site A soils. Slow diffusion of wash water through the low-permeability soil at Site A, limited the effectiveness of the passive soil leaching process. However, addition of more permeable sand to the Site A soil matrix in a 1:1 volume ratio achieves breakup of agglomerated silt and clay, resulting in reduced channeling and increased hydraulic conductivity. Addition of low concentrations of calcium chloride to the wash water (up to 40 mg/L) also increases the hydraulic conductivity, enhancing system operation. The treatability studies demonstrated that sand amendment and calcium chloride addition are necessary in order to optimize the passive leaching of ordnance contaminants from Site A soils.

Treat Leachate Using GAC Instead of UV/Ox Technology

The ROD stipulates that, pending successful completion of water treatability studies, UV/Ox technologies will be used to treat leachate from the passive soil leaching process. The water treatability studies, which were conducted using ordnance-contaminated groundwater from SUBASE, Bangor Site F, demonstrated that UV/Ox treatment is capable of destroying dissolved ordnance compounds to below cleanup criteria. However, GAC was reevaluated for leachate treatment when the anticipated leachate recirculation flow rate increased to 300 gpm (based on soil treatability study results) and new information became available regarding the cost and implementability of GAC technology.

The original decision to use UV/Ox instead of GAC resulted from the Feasibility Study's consideration of EPA's nine basic criteria for evaluating remedial alternatives. UV/Ox was judged to offer advantages in terms of implementability and cost. However, the basis for characterizing GAC technologies as relatively less implementable than UV/Ox was the limited availability of facilities capable of regenerating or disposing of spent (ordnance-laden) GAC. In addition, for the leachate concentrations assumed in the RI/FS, the estimated cost of leachate treatment was lower for UV/Ox than for GAC.

Based on current information, the implementability of GAC is no longer a problem. The carbon manufacturer/supplier selected by the Navy's Remedial Action Contractor (RAC) for the Interim Remedial Action at SUBASE, Bangor, Site F, is now capable and willing to accept ordnance-laden GAC at their carbon regeneration facility. The previous reluctance to handle the spent GAC, which was based on the concern regarding regeneration, can now be effectively addressed by limiting ordnance loading on the GAC. Accordingly, GAC is now equally as implementable as UV/Ox technology. Since adsorbed ordnance compounds are thermally destroyed in the regeneration process, this treatment technology also satisfies the statutory preference for permanent treatment to reduce toxicity, mobility, and volume.

Since the signing of the ROD, the estimated costs for treating Site A leachate using UV/Ox have roughly doubled. This is mainly due to the much higher leachate design flow rate currently envisioned (300 gpm versus 50 gpm assumed in the FS) with the sand-amended soil. Current cost estimates for GAC treatment are only marginally higher than previous estimates. In this case, the higher costs associated with the 6-fold increase in leachate flow rate are largely offset by the much lower carbon replacement cost that can now be achieved through GAC regeneration.

Soil remediation cost estimates corresponding to the 10th and 90th percentile confidence intervals were calculated (using Monte Carlo simulation methods; Palisades Corp. @RISK software) by incorporating operation and maintenance uncertainties associated with both treatment duration and achievable leachate recirculation flow rates. The results of these analyses are presented in Table 1. Previous estimates presented in the RI/FS and the ROD are also shown for comparison.

Based on the data now available, GAC is proposed for use in place of UV/Ox for treating Site A leach basin leachate. (UV/Ox will be the back-up technology to be used in the unlikely event that thermal destruction of adsorbed ordnance compounds proves impracticable.) The probable range in total soil remediation costs associated with this system is $1,700,000 to $2,100,000, which is 20 to 50 percent higher than the selected soil remedy as presented in the ROD.

Regulations, which apply to transporting GAC to and from Site A, will be included as ARARs for the remedial action. Transport of this material will be conducted in accordance with all applicable local, state, and federal transportation regulations. Fresh GAC transported onto the site will not be a hazardous waste and standard shipping regulations will apply. Spent GAC to be transported off of the site will be subjected to toxicity characteristic leaching procedure (TCLP) and explosivity tests prior to transport to determine whether the material is a hazardous waste. In the unlikely event that a hazardous waste is generated by the treatment process, it will be transported in accordance with all applicable regulations.

Leave in Place Limited Volume of Lead-Contaminated Soils in Debris Area 2

TNT and lead concentrations exceeding RAOs were detected in an estimated 100 cubic yards of Debris Area 2 soil during the RI/FS investigation. The ROD stipulates that this soil would be excavated and placed in an isolated cell within the leach basin. Following leaching of TNT, the lead-contaminated soil would be disposed of at a permitted off-site landfill.

In preparing to carry out the above plan, the Navy's RAC further evaluated Debris Area 2, producing the following additional information:

1) **Soil Excavation on the Steeply Sloping Site May Impact Sensitive Habitats in the Cattail Lake Basin.** Debris Area 2 is located in a steeply sloping, heavily wooded drainage area containing significant undergrowth. The slope incline is estimated to be 0.75 horizontal to 1.0 vertical. A stream at the bottom of the slope flows into Cattail Lake, which is located approximately 100 yards further down the drainage. The Cattail Lake basin supports unique and diverse flora and fauna habitats, as described in Attachment A.

   The Navy's RAC evaluated a range of strategies and technologies for excavating soil from Debris Area 2. All excavation strategies would require the removal of trees and undergrowth, which aid in stabilizing the slope, and considerable overexcavation for site access and equipment operation. The RAC concluded that these activities may cause destabilization of the slope, resulting in significant soil erosion both during the remedial activities and following such activities, until the slope restabilizes through revegetation. Soil erosion would likely impact sensitive habitats in the Cattail Lake basin.

2) **Maximum Concentrations of TNT and Lead in Debris Area 2 Soil are Lower than Measured during the RI/FS Investigation.** The RAC conducted a more comprehensive sampling program than that previously performed during the remedial investigation, to further define the extent of Debris Area 2 soil contamination. Their results are summarized in Table 2 along with the results collected during the Remedial Investigation (RI). Both sampling programs identified TNT and lead as compounds exceeding RAOs in site soils. However, maximum concentrations measured during the Remedial Action are lower than those measured during the RI. (As shown in Table 2, TNT and lead concentrations exceeded the RAOs in only a limited number of samples.) Maximum TNT and lead concentrations of 53 and 660 mg/kg, respectively, were detected during the Remedial Action. These compare with RAOs for TNT and lead of 33 and 250 mg/kg, respectively (based on Washington State Model Toxics Control Act [MTCA] direct contact soil cleanup levels, assuming residential use).

Only one of the 20 soil samples analyzed during Remedial Action (five percent of the sample pool) exceeds the RAO for TNT, and that exceedence (53 mg/kg) is less than twice the RAO of 33 mg/kg. Therefore, based on the more comprehensive (and more recent) sampling results, Debris Area 2 satisfies ordnance cleanup criteria without soil excavation. Lead concentrations exceed the lead RAO in five of the 20 samples (25 percent of the sample pool). The highest concentration detected is less than three times the lead RAO.

The RAC now estimates the volume of lead-contaminated Debris Area 2 soils to be in the range of 60 to 130 cubic yards. This is consistent with the RI/FS preliminary estimate of 100 cubic yards, and represents less than two percent of the total volume of Site A soils exceeding cleanup criteria.

Based on the above information, it is now proposed that the lead-contaminated soil at Debris Area 2 be left in place. Potential damage to sensitive habitat in the Cattail Lake basin may result due to soil erosion if soil excavation occurs. The volume of contaminated soil is relatively small, and the maximum contaminant (lead) concentration detected in that soil exceeds the cleanup standard by less than a factor of three. The contaminant is effectively bound to the soil, and therefore presents no significant risk to groundwater. The overall risk to human health and the environment associated with excavating the soil is judged to be greater than the risk associated with leaving the soil in place.

Institutional controls will be implemented to restrict future access to the Debris Area 2 slope. These controls will include a combination of barriers (e.g., fences, blackberry bushes, etc.) and warning signs. In addition, the SUBASE, Bangor, Master Plan will be revised to restrict future residential development in the vicinity of Debris Area 2.

Begin Treating Groundwater by July 1, 1996

Groundwater flows relatively slowly through the Shallow Aquifer beneath the Burn Area, where limited ordnance contamination has been detected. The ROD states that groundwater treatment will be implemented to achieve RAOs once soil remediation is completed. Soil remediation using passive soil leaching is currently estimated to require less than 2 years of leach basin operation. However, due to uncertainties associated with the leaching process, it is possible that more than 2 years of basin operation may be required.

In order to limit the migration of contaminants in the Shallow Aquifer, a deadline of July 1, 1996, is proposed for implementation of groundwater treatment at Site A. This deadline ensures that initiation of groundwater treatment will not be postponed due to unforeseen delays in the soil remediation schedule. UV/Ox will still be used for treatment of extracted groundwater (at flow rates much lower than those required for the Passive Soil Wash leachate treatment), as stipulated in the Site A ROD.

Periodic groundwater monitoring will be conducted in both the Perched Groundwater Zone and in the Shallow Aquifer during the period proceeding the above deadline.

Affirmation of the Statutory Determinations

Considering the new information that has been developed for Site A, the lead agency believes that the remedy as changed is protective of human health and the environment to the maximum extent possible, and is cost-effective. Federal and state requirements that were identified in the ROD as applicable or relevant and appropriate will be met, with one exception: a small volume (60 to 130 cubic yards) of soils with lead concentrations above cleanup standards will be left in place on the steep slope of Debris Area 2. The risk to human health and the environment associated with excavating this soil is judged to be greater than the risk associated with leaving the soil in place.

The revised remedy utilizes permanent solutions. GAC was considered as an alternative treatment technology during development and selection of the original remedy. It is now considered to be equivalent to UV/Ox in terms of effectiveness and implementability. The deadline for implementation of groundwater remediation enhances protection of human health and the environment.

Public Participation Activities

Public notice of this ESD will be published in a major local newspaper. Notice has been issued previously that the contents of the Administrative Record File are available for public review and comment. The GAC treatment technology has been discussed and presented to the public at previous meetings conducted to explain the remedial action alternatives and selected remedies for Site A and for an Interim Action for the treatment of ordnance contaminated groundwater at Site F. A fact sheet will be issued explaining this ESD.

146325\SITEA.ESD

Attachments:
Table 1 - Site A Soil Remediation Cost Estimates
Table 2 - Summary of Debris Area 2 Soil Sampling Results
A - Debris Area 2, Remedial Action Ecological Comments

Table 1 - Site A Soil Remediation Cost Estimates

		Soil Remediation Cost Estimates[1]			
		Total Cost in Millions of Dollars		Unit Cost in Dollars per Ton	
	Probability	UV/Ox	GAC	UV/Ox	GAC
Current Estimates[2]	10%	2.7	1.7	250	160
	90%	2.9	2.1	270	190
Feasibility Study Estimates	NA	1.4	1.6	130	150

NA = Not applicable.

146325/SITEA.ESD

1 Estimates include costs for final design, construction, operation and maintenance, monitoring and analytical, and post-remediation requirements. Present-worth cost adjustments have been neglected. Groundwater treatment costs are not included.

2 Current estimates are based on purchasing a 300 gpm UV/ozone system for leachate treatment versus leasing a 300 gpm GAC system. (UV/ozone systems of this size are not available for lease.)

Table 2 - Summary of Debris Area 2 Soil Sampling Results

	Remedial Investigation	Remedial Action
Dates of Sampling	1988-1990	May 1993
No. of Discrete Soil Samples Analyzed	5	20
Compounds Detected Above RAOs[1]	TNT/Lead	TNT/Lead
No. of Exceedences[2] ► TNT ► Lead	1 (20%) 1 (20%)	1 (5%) 5 (25%)
Maximum Concentration ► TNT Detected in mg/kg ► Lead	72 940/2,400	53 660
Estimated Volume of Soil Exceeding RAOs in Cubic Yards	100	60 to 130

1 The remedial action objectives (RAOs) for TNT and lead in soil are 33 and 250 mg/kg, respectively. These are based on Washington State Model Toxics Control Act (MTCA) direct contact soil cleanup levels, assuming residential use.

2 The limited sampling conducted during the Remedial Investigation indicated that both TNT and lead contamination were limited to the upper half of the Debris Area 2 slope. The more comprehensive sampling program conducted during the Remedial Action confirmed this conclusion.

146325\SITEA.ESD

ATTACHMENT A
NAVAL SUBMARINE BASE, BANGOR OPERABLE UNIT 1
DEBRIS AREA 2, REMEDIAL ACTION ECOLOGICAL COMMENTS

DEPARTMENT OF THE NAVY
NAVAL SUBMARINE BASE, BANGOR
SILVERDALE, WA 98315-1199

6280
Ser 8513/001916
03 AUG 1993

From: Commanding Officer, Naval Submarine Base, Bangor
To: Commanding Officer, Engineering Field Activity, Northwest (Attn: Code 09E02GR)

Subj: OPERABLE UNIT 1, DEBRIS AREA 2 REMEDIAL ACTION

Encl: (1) Naval Submarine Base, Bangor Operable Unit 1, Debris Area 2, Remedial Action Ecological Concerns

1. Enclosure (1) is forwarded per your request. If you have any questions, please contact Ms. Patty Kelly at 396-5099 or Mr. Tom James at 396-5097.

Marvin J Frye

MARVIN J. FRYE
By direction

OPTIONAL FORM 99 (7-90)
FAX TRANSMITTAL # of pages ► 2

To CRAIG THOMPSON	From GERRY RIEGER
Dept./Agency ECOLOGY	Phone # (206) - 396-5984
Fax # (206) 438-3050	Fax # -5995
NSN 7540-01-317-7368 5099-101	GENERAL SERVICES ADMINISTRATION

CRAIG - ADD TO THURS AGENDA. GR

OPTIONAL FORM 99 (7-90)
FAX TRANSMITTAL # of pages ► 2

To JEFF RODIN	From GERRY RIEGER
Dept./Agency EPA	Phone # (206) 396-5984
Fax # (206) 553-0957	Fax # -5995
NSN 7540-01-317-7368 5099-101	GENERAL SERVICES ADMINISTRATION

JEFF! ADD TO THURS AGENDA GR

OPTIONAL FORM 99 (7-90)
FAX TRANSMITTAL # of pages ► 2

To PATTY KELLY	From GERRY RIEGER
Dept./Agency SUBASE BANGOR	Phone # -5984
Fax # -7196	Fax # -5995
NSN 7540-01-317-7368 5099-101	GENERAL SERVICES ADMINISTRATION

PATTY - ADD TO THURS AGENDA GR

NAVAL SUBMARINE BASE, BANGOR
Operable Unit 1, Debris Area 2
Remedial Action Ecological Concerns

Debris Area 2 is a steep embankment located along a stream that enters Cattail Lake approximately 100 yards away. Cattail Lake was formed in the mid-1940s when the U. S. Navy filled in a bridged road over a stream for security reasons. Unique and diverse flora and fauna habitats have developed in Cattail Lake over the years. They are as follows:

CUTTHROAT TROUT

(1) Cutthroat Trout was isolated and has been naturally reproducing since Cattail Lake was created in the mid-1940s. This population has evolved into a genetically unique group and should be preserved.

SPOTTED FROGS AND RED-LEGGED FROGS

(2) Naval Submarine Base, Bangor personnel have observed the Spotted Frog and the Red-Legged Frog in the Cattail Lake area. Both species are proposed for the Endangered Species Act listing.

BEAVER

(3) There is a beaver dam at the mouth of the creek entering Cattail Lake. This animal is considered rare in North Kitsap County due to habitat degradation.

OSPREY

(4) Osprey have nested at Cattail Lake since 1984. Young have fledged successfully in each of the subsequent years.

WETLAND

(5) The mouth of the stream entering Cattail Lake has evolved into a high grade wetland.

Due to the steep embankment and the proximity of the stream feeding Cattail Lake, excavation may seriously jeopardize the above habitat.

EXPLANATION OF SIGNIFICANT DIFFERENCES (ESD)
FOR THE INTERIM REMEDIAL ACTION
SITE F
SUBASE, BANGOR
BANGOR, WASHINGTON

Introduction

Site F at the Naval Submarine Base, Bangor (SUBASE, Bangor) is located in the south-central portion of the SUBASE. SUBASE, Bangor is located on Hood Canal in Kitsap County, Washington, approximately 10 miles north of Bremerton. The lead agency for this National Priorities List (NPL) site is the U.S. Navy. The U.S. Environmental Protection Agency (EPA) and the Washington State Department of Ecology (Ecology) have provided support and oversight on the preliminary studies, site investigations, remedial alternative selection, and design and construction of the Interim Remedial Action (IRA) at Site F.

This ESD is prepared in accordance with Section 117(c) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and Section 300.435(c)(2)(i) of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). It addresses the change from ultraviolet/oxidation (UV/Ox) technology to granular activated carbon (GAC) technology for treatment of groundwater extracted under the Site F IRA. A reevaluation of these technologies concluded that GAC treatment of the extracted groundwater is equally implementable, equally effective, and substantially less expensive than UV/Ox treatment.

Public notice of this ESD will be published in a major local newspaper. The ESD will be available for review in the information repositories located at the following Kitsap regional libraries:

Central Kitsap Library (206) 377-7601
1301 Sylvan Way
Bremerton, Washington 98310

Bangor Branch (206) 779-9724
Naval Submarine Base, Bangor
Silverdale, Washington 98315-5000

The ESD will also become part of the Administrative Record File in accordance with NCP 300.825(a)(2). The Administrative Record for Site F is available between the hours of 0800 and 1600 at:

Engineering Field Activity, Northwest
Naval Facilities Engineering Command
1040 Hostmark Street
Poulsbo, WA 98370
(206) 396-5984

Summary of Site History, Contamination Problems, and Selected IRA

The Bangor Naval complex served as a munitions handling, storage, and processing site from the early 1940s until 1971. Site F, which consists of a former unlined lagoon and overflow ditch, was used between approximately 1960 and 1971 for the disposal of wastewater produced during the demilitarization of ordnance items in an adjacent Segregation Facility. Demil activities conducted in the Segregation Facility included initial separation of solid ordnance from the projectile casings, followed by steam cleaning of the casings. Condensate and ordnance residual from this process were collected in a holding tank. Holding tank effluent was treated in skimming and settling chambers to remove solids prior to discharge to the lagoon.

The wastewater discharged to the unlined lagoon contained relatively high residual concentrations of trinitrotoluene (TNT) and hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX), and lower concentrations of other ordnance compounds. Much of the wastewater apparently infiltrated through the bottom of the lagoon. During periods of heavy discharge, however, wastewater overflowed the lagoon into a narrow depression (ditch) to the south. Periodically, the lagoon was allowed to drain, and waste materials at the surface of the lagoon were "burned off" in place or transported off site for burning and disposal.

No records were kept on the quantity of wastewater disposed of to the lagoon. In 1972-73, the lagoon was taken out of service, and process wastewater was subsequently collected in drums and delivered to the SUBASE, Bangor liquid-waste incinerator. The rate of wastewater delivery to the incinerator was estimated at 240 gallons per day.

In 1980, demil operations were terminated and the former lagoon area was filled in and covered with asphalt. The Segregation Buildings were subsequently decontaminated and converted to storage.

In 1978, evaluation of SUBASE, Bangor waste disposal sites (including Site F) began under the Navy Assessment and Control of Installation Pollutants (NACIP) program. Work at Site F continued in 1981 as part of an Initial Assessment Study (IAS) and in 1986 as part of a Characterization Study, both under the NACIP program. With the enactment of the Superfund Amendments and Reauthorization Act (SARA) in 1986, the Navy suspended further NACIP program activities and phased into the EPA Remedial Investigation/Feasibility Study (RI/FS) program. In August 1990, SUBASE, Bangor (including Site F) was officially listed on the National Priorities List (NPL) of Hazardous Waste Sites. The RI/FS investigation for the final remedial action at Site F is currently ongoing.

The disposal of ordnance wastewater at Site F resulted in contamination of soil and groundwater. Roughly 75 percent of the estimated total mass of ordnance at Site F is present within unsaturated soils beneath the former wastewater lagoon and overflow ditch. The remaining 25 percent is present in the Shallow Aquifer, an unconfined aquifer located at a depth of approximately 50 feet beneath the site. Water quality data indicate that RDX has been transported in the Shallow Aquifer up to approximately 3,000 feet downgradient (west-northwest) of the former lagoon. Other ordnance compounds, such as TNT and DNT, have migrated less than 1,500 feet downgradient, and remain well within the extent of elevated RDX concentrations in the aquifer.

The Record of Decision (ROD) for the Site F IRA was signed in September 1991. It addresses the threat posed by the site by providing groundwater containment and on-site treatment with permanent reduction in the mobility, toxicity, and volume of contamination. The elements of the Site F IRA as set forth in the ROD include:

- Extraction of groundwater from the Shallow Aquifer to contain the contamination and thereby confine further contaminant movement in the aquifer;

- Treatment of the extracted groundwater using UV/Ox technologies to meet applicable regulations prior to disposal;

- Disposal of the treated groundwater on base by recharge or injection into the Shallow Aquifer; and

- Monitoring the effectiveness of the groundwater containment and groundwater treatment processes.

Description of the Significant Differences and the Basis for Those Differences

UV/Ox and GAC were evaluated in the ROD for the Site F IRA as alternative technologies for treatment of extracted groundwater. The estimates prepared at that time showed comparable costs for these technologies. UV/Ox was selected for the following reasons:

- UV/Ox was considered to be more "implementable", due to limited availability of facilities capable of regenerating or disposing of spent GAC;

- UV/Ox provides on-site destruction of contaminants; and

- UV/Ox is an innovative technology.

Based on current information, the implementability of GAC is no longer a problem. The carbon manufacturer/supplier selected by the Navy's Remedial Action Contractor (RAC) is now capable and willing to accept ordnance-laden GAC at their carbon regeneration facility. Their previous reluctance to handle the spent GAC, which was based on carbon regenerability considerations, can now be effectively addressed by limiting ordnance loading on the GAC. Accordingly, GAC is now considered equally as implementable as UV/Ox technology. Since adsorbed ordnance compounds are thermally destroyed in the regeneration process, this treatment technology also satisfies the statutory preference for permanent treatment to reduce toxicity, mobility, and volume.

Table 1 presents current cost estimates for the Site F IRA using UV/Ox versus GAC for groundwater treatment. Treatment by UV/Ox is estimated to cost $800,000 more than treatment by GAC, based on two years of IRA operation. This is primarily due to the large difference in treatment technology capital costs. A treatment plant using either technology would require many common items, such as process pumps, holding tanks, filters for suspended solids removal, and interconnecting piping. The only significant "unique" equipment required for GAC treatment are process vessels to hold the activated carbon itself. The GAC cost estimate assumes that a Calgon Model 10 Dual Adsorption Unit is purchased for this purpose at a cost of approximately $190,000.

Equipment requirements and costs for UV/Ox treatment are based on the findings of the UV/Ox Treatability Study performed for Site F. In addition to the UV/Ox reactor itself, UV/Ox treatment would require facilities for ozone generation, acid and base storage/injection (for water pH adjustment), gas recompression/recycling, and destruction of residual ozone in the offgas. The capital cost of equipment unique to UV/Ox treatment is estimated at $800,000. The equipment cost differential between treatment technologies is therefore estimated at $610,000. Applying a contingency factor of 15 percent (to account for unforeseen additional costs) results in the capital cost differential of $700,000 as shown in Table 1.

The corresponding cost estimates provided in the Site F IRA ROD are also shown in Table 1 for comparison. Estimates of total costs for both technologies have dropped since the ROD evaluation. This is due to the much lower costs now estimated for system operation and maintenance (O&M) in both cases. Lower O&M costs partly result from the lower ordnance concentrations, that are now anticipated in the extracted groundwater. This concentration reduction has a greater impact on GAC O&M costs, since they are more concentration-dependent than are UV/Ox O&M costs.

Another reason why GAC O&M costs have declined is that, as noted above, spent carbon can now be regenerated for reuse. The UV/Ox Treatability Study, on the other hand, demonstrated that substantial reductions in UV/Ox O&M costs were also justified.

The net result based on these analyses and present technology, however, is that GAC is now estimated to be significantly less expensive than UV/Ox from both a capital and an O&M cost perspective.

GAC treatment still requires off-site transport of contaminants prior to their ultimate destruction. However, the lower anticipated influent ordnance concentrations mentioned above result in a much lower spent carbon generation rate. Current estimates indicate that, for a 225 gpm treatment rate, only about two 20,000-pound truckloads of spent carbon per year will require transport to a regeneration facility.

The distinction of UV/Ox as an innovative technology still applies as well. However, the greater cost-effectiveness of GAC treatment outweighs the UV/Ox advantages of on-site contaminant destruction and innovative technology.

Based on the data now available, GAC is proposed for use in place of UV/Ox to treat extracted groundwater under the Site F IRA. (UV/Ox will be the back-up technology, to be used in the unlikely event that thermal destruction of adsorbed ordnance compounds proves impracticable.) Regulations, which apply to transporting GAC to and from Site F, will be included as ARARs for the remedial action. Transport of this material will be conducted in accordance with all applicable local, state, and federal transportation regulations. Fresh GAC transported onto the site will not be a hazardous waste and standard shipping regulations will apply. Spent GAC to be transported off of the site will be subjected to toxicity characteristic leaching procedure (TCLP) and explosivity tests prior to transport to determine whether the material is a hazardous waste. In the unlikely event that a hazardous waste is generated by the treatment process, it will be transported in accordance with all applicable regulations.

Affirmation of the Statutory Determinations

Considering the new information that has been developed for the Site F IRA, the lead agency believes that the remedy as changed is protective of human health and the environment, complies with federal and state requirements that were identified in the ROD as applicable or relevant and appropriate to this remedial action at the time the original ROD was signed, and is cost-effective. The revised remedy utilizes permanent solutions. GAC was considered as an alternative treatment technology during development and selection of the original remedy. It is now considered to be equivalent to UV/Ox in terms of effectiveness and implementability.

Public Participation Activities

Public notice of this ESD will be published in a major local newspaper. Notice has been issued previously that the contents of the Administrative Record File are available for public review and comment. The GAC treatment technology has been discussed and presented to the public at previous meetings conducted to explain the alternatives and selected remedy for the Site F IRA. A fact sheet will be issued explaining this ESD.

Attachment: Table 1 - Site F Interim Remedial Action Cost Estimates

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Table 1 - Site F Interim Remedial Action Cost Estimates

	Cost in Thousands of Dollars			
	Current Estimates[1]		IRA ROD Estimates[2]	
Groundwater Treatment Technology	UV/Ox[3]	GAC[4]	UV/Ox	GAC
Capital	2,000	1,300	1,200	900
Operation & Maintenance (O&M) (Based on 2 years of operation)	300	200	1,300	1,600
Total Estimated Cost	2,300	1,500	2,500	2,500

1 Current capital estimates are based on a 300 gpm design flow rate, with 15 percent contingency. Current O&M estimates assume a typical operating flow rate of 225 gpm.

2 The IRA ROD cost estimates assume a flow rate of 200 gpm (both design and actual operation) with no contingency.

3 Current UV/Ox treatment cost estimates are based on quotes provided by Solarchem during the UV/Oxidation Treatability Study performed for Site F.

4 Current GAC treatment cost estimates are based on quotes provided by Calgon Carbon Corporation.

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RESPONSES TO SELECTED COMMENTS PROVIDED BY EPA (DATED OCTOBER 15, 1993) AND ECOLOGY (DATED NOVEMBER 9, 1993) REGARDING THE DRAFT ESD's FOR SITES A AND F, SUBASE, BANGOR

Responses to Selected EPA Comments

ESD for Site A, page 2, third paragraph and page 7, last paragraph - Prior to startup of groundwater extraction/treatment at Site A, groundwater monitoring is currently proposed to be conducted semi-annually. As stated on page iii of the Site A ROD, the effectiveness of the groundwater extraction and treatment process will be monitored throughout the groundwater remediation period. Specific performance monitoring plans will be developed prior to system startup.

In response to EPA's query, the Administrative Record for Site A is available only at the EFA-NW office in Poulsbo. However, the ESDs will also be available for review in the information repositories at the Central Kitsap and Bangor Branch libraries.

ESD for Site A, page 3, top paragraph - Recent sampling of stormwater discharge area sediment did not detect any ordnance compounds at concentrations above remedial action objectives.

ESD for Site A, page 4, last paragraph - The Navy's Remedial Action Contractor (RAC) selected Calgon based on that company's ability to provide comprehensive activated carbon service (transport and regeneration of spent GAC as well as the manufacture of GAC and off-the-shelf treatment equipment). Calgon already accepts ordnance-loaded GAC from at least one commercial facility. The Calgon furnace tests scheduled for January 1994 will determine the maximum ordnance loadings on spent GAC from Sites A and F that Calgon will accept for regeneration.

To date, we have not discussed regeneration of ordnance-loaded GAC with other companies that provide regeneration services. We are not aware that anyone else currently accepts ordnance-loaded GAC for regeneration. However, there is nothing unique about Calgon's regeneration process that allows only Calgon to regenerate ordnance-loaded GAC. (Calgon makes no such claims.) Therefore, after Calgon demonstrates successful regeneration of spent GAC from Sites A and F, we would expect other regenerators to be ready and willing to provide the same service.

Responses to Selected Ecology Comments

ESD for Site A, page 4, last paragraph, and ESD for Site F, page 3, first paragraph after bullets - See above discussion regarding regeneration of ordnance-laden GAC.

Enclosure (3)